

REMARKS

This application has been amended in a manner believed to place it in condition for allowance.

Status of the Claims

Claims 5, 6, 9, and 13 are amended to recite that there is a chromium layer, which is not oxidized, that remains between the chromium-oxide passivation film and remains adhered to the metallic material so that the chromium oxide passivation film is coupled to said metallic material.

Support for the amendment to the claims may be found generally throughout the specification, for example, at page 9, lines 5-10, which describes the chromium oxide passivation (which includes the outer surface of 100% chromium oxide) as having excellent adhesion at the interface between the metallic material and the chromium-coat film. Figure 2 further suggests this structure.

Claims 5, 6, 9, 13-16 and 18-21 remain pending in the application.

Claims Rejections-35 USC §103(a)

Claims 5, 6, 9, 13-16 and 18-21 were rejected under 35 USC §103(a) for being unpatentable over CARBO et al. U.S. 4,507,339 (CARBO) in view of UCHIDA et al. U.S. 4,248,676

(UCHIDA) and OHMI U.S. 5,656,099 (OHMI). This rejection is respectfully traversed.

The independent claims 5, 6, 9, and 13 are directed to an article and structures that include a metallic material having a surface roughness (Ra) of not more than 1.5 μ m, and a chromium oxide passivation film formed on the metallic material surface, wherein the chromium oxide film is formed by heating a chromium film coated directly onto the metallic material surface in an oxidizing atmosphere.

As a result of forming the chromium oxide passivation film in this claimed manner, substantially 100% chromium oxide exists at least 30 nm from the outermost surface of the chromium oxide passivation film. That is, as shown in Figure 2, up to about 30 nm from the outermost surface of the coated chromium film after heated in an oxygen atmosphere contains 40% chromium and 60% oxygen after oxidation, i.e., up to about 30 nm from the outermost surface the oxidized film is Cr₂O₃.

However, as now recited, there remains a chromium layer between the metallic material surface and the 100% chromium oxide layer, which has not been oxidized and provides an adhesion between the chromium oxide passivation film and the metallic material. That is, of the chromium film initially coated directly onto the metallic material surface, the outer surface layer forms 100% chromium oxide, and the layer of the chromium coat film (i.e. chromium layer) which initially contacted the

metallic material surface remains adhered to the metallic material surface.

The advantage of this feature is that if the outer surface chromium oxide layer develops any defects, e.g., pin holes, the chromium layer coated over and adhered to the surface of the metallic material seals these holes. Thus, the problem of interface corrosion is solved, as discussed on page 6, lines 1-5 and page 9, lines 7-17.

The proposed combination fails to render obvious the claims for the following three reasons:

I. The combination fails to teach pin holes that are sealed.

One position of the Official Action was that it would have been obvious to fill the pin holes of the passivation film of CARBO as taught by UCHIDA in order to prevent crack formation.

However, their combination does not teach the claimed structure, namely a chromium layer between the surface of a metallic material and a chromium oxide layer.

CARBO discloses steel with "a chromium/chromium oxide surface treatment", wherein the concentration is defined as:

"The chromium in the oxide is present at about 0.5 to 2.0 mg per square feet and the chromium metal at about 3 to 13 mg per square foot."

That is, if there are pin holes in CARBO they are in a chromium/chromium oxide layer, as CARBO fails to disclose or suggest an outer surface 100% chromium oxide layer, wherein a

chromium layer is located between the 100% chromium oxide layer and the metal surface.

UCHIDA fails to remedy these shortcomings of CARBO for reference purposes. UCHIDA discloses filling holes of an electroplated chromium layer covering a metal surface with a chromate (chromium hydrate and/or chromium oxide) layer. This neither teaches nor suggests a chromium layer between a metal surface and chromium oxide layer of a particular depth, wherein the pin holes of the chromium oxide layer are sealed.

Even if one were to make the combination as suggested, at best, the combination teaches "*a chromium/chromium oxide surface treatment*", with particular concentrations of chromium in the oxide and chromium metal, and a chromium hydrate and/or chromium oxide layer applied over the chromium/chromium oxide layer to fill the chromium/chromium oxide layer.

II. The combination fails to teach the claimed layers.

Another position of the Official Action was that it would have been obvious to one of ordinary skill in the art to use a chromium oxide as the passivation film in the combination of CARBO and UCHIDA, as taught by OHMI, since an improved corrosion resistance could be gained by a layer consisting only of chromium oxide, and, thus, all of the film would be 100% chromium oxide.

As discussed above, the combination of CARBO and UCHIDA

teaches "a chromium/chromium oxide surface treatment", with particular concentrations of chromium in the oxide and chromium metal, and a chromium hydrate and/or chromium oxide layer applied over the chromium/chromium oxide layer to fill the chromium/chromium oxide layer.

OHMI was offered for teaching a chromium oxide passivation film consisting of chromium oxide which provides improved corrosion resistant properties.

It is assumed that the Official Action intends to replace film formed by the "chromium/chromium oxide surface treatment" of CARBO with a chromium oxide film, e.g., as suggested by. OHMI obtains the film by direct formation, which UCHIDA considers unsuitable for the structures taught by CARBO and UCHIDA, i.e., films formed in this manner are not suitable for those metal surfaces that require subsequent surface treatment of an organic coating, e.g., as in the use of cans (see the paragraph bridging columns 2 and 3 of UCHIDA).

However, even if one merely substitutes a 100% chromium oxide film for the "chromium/chromium oxide surface treatment", the combination fails to teach an outer surface 100% chromium oxide layer, wherein a chromium layer is located between the 100% chromium oxide layer and the metal surface.

Indeed, this not possible with the OHMI process, as OHMI discloses the chromium oxide passivation film is a layer of the metallic material, i.e., the film is integral with the

material. Thus, there can be no chromium layer adhered to the metal surface and between the metal surface and the 100% chromium oxide layer.

III. The claimed process steps result in the claimed structure.

The Official Action does not consider the claimed process steps as having any patentable weight.

However, as evidenced by the fact that none of the cited documents, alone or in combination, teaches the claimed structure, the manner of forming the chromium passivation film does distinguish the claimed passivation film over those films of the cited documents.

That is, none of the cited documents suggests a chromium layer adhered to a metal surface and between the metal surface and a 100% chromium oxide layer so that the chromium oxide layer is coupled to the metal surface, where pin holes of the 100% chromium oxide layer are sealed.

Conclusion

In view of the amendment to the claims and the foregoing remarks, applicants believe that the present application is in condition for allowance at the time of the next Official Action. Allowance and passage to issue on that basis is respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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